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REMARKS

Claims 1, 3-18 and 20-40 are pending in the application. In the Office Action at hand, Claims 4, 7-15 and 21-40 are withdrawn from consideration, and Claims 1, 3, 5, 6, 16-18 and 20 are rejected.

In particular, Claims 1, 5, 6, and 16-18 are rejected under 35 U.S.C. §103(a) as being unpatentable over Melton in view of Koning and JP 57152438. Also, Claims 3 and 20 are rejected under Section 103(a) as being unpatentable over Melton, Koning, JP 57152438 and Beal. Finally, Claims 1, 3, 5, 6, 16-18 and 20 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1 and 3-6 of copending Application No. 10/744,326. In response to the Section 103(a) rejections, and the obvious-type double patenting rejection, the Applicants respectfully submit that Claims 1, 3, 5, 6, 16-18 and 20, as amended, are not anticipated or obvious in view of Melton, Koning, JP 57152438, and Beal, or unpatentable in view of Application No. 10/744,326. Reconsideration is respectfully requested.

Claim 1, as amended, recites a solder composition including an alloy comprising tin (Sn) and silver (Ag). A granular additive pretreated with flux added to the granular additive is included, and is at least about 3% of the solder composition by weight. Only the granular additive is pretreated with flux, and comprises spheres of a nickel iron alloy 50-140 microns in size with about 36% nickel (Ni) and about 64% iron (Fe), by weight. The pretreated granular additive is in granular form within said alloy and is wetted with the alloy by the flux. Claim 16, as amended, recites a solder composition including a granular material having a material of a low coefficient of thermal expansion.

Claim 1 has been amended to recite "only the granular additive being pretreated with flux and comprising spheres of a nickel iron alloy 50-140 microns in size comprising about 36% nickel (Ni) and about 64% iron (Fe)", and Claim 16 has been amended to recite "a granular additive pretreated with flux added to the granular additive and comprising spheres of a material having a low coefficient of thermal expansion 50 140 microns in size". Support for these amendments is found out at least on page 7, lines 3-10 of the specification as originally filed.

Claims 1, 3, 5, 6, 16-18 and 20, as now amended, are now patentably distinct over Claims 1 and 3-6 of copending Application No. 10/744,325, thereby overcoming the nonstatutory obviousness-type double patenting rejection.

In the claimed invention, the use of a granular additive with a low coefficient of thermal expansion that remains in granular form within a lead free solder, such as a tin silver alloy, and which is at least about 3% of the solder composition, can allow the solder to be used for soldering to a glass substrate. Granules of the granular additive that are evenly dispersed in the solder alloy and remain in granular form can combat thermal shock to the glass substrate and can prevent the solder from separating from the glass substrate or prevent cracking of the glass substrate. However, obtaining proper mixing and an even dispersion of the granular additive (for example, formed of a 36% nickel 64% iron alloy) within a tin silver alloy typically cannot be obtained by merely mixing the tin, silver and granular additive together and melting, as is the common method for forming solder compositions. Mere mixing and melting of the tin, silver and granular additive can result in poor mixing and/or clumping of the granular additive, for example, floating on top of the solder, and therefore, little or uneven dispersion of the granular additive within the solder alloy. An even dispersion of the granules is desired for use with glass, since little or uneven dispersion of granular additive can result in the solder separating from or cracking the glass.

The Applicants have found that by pretreating only the granular additive, for example, formed of a nickel iron alloy, with flux added to only the granular additive before mixing the granular additive with a molten tin silver alloy, the granular additive can easily wet with the solder and mix in and remain in granular form within the molten alloy in a generally evenly dispersed manner. Having the tin silver alloy already in a molten form before the granular additive is added can aid in evenly dispersing the granules of the granular additive.

The Applicants have further discovered that employing spheres of the granular additive, 50-140 microns in size, can promote and maintain even dispersion within the solder,as well as adsorb stress. Spheres do not have interlocking surfaces which can cause locking and clumping. In addition, the shape of spheres trapped within the solder can adsorb stress caused by temperature changes on the solder and prevent the high contraction rate of the solder. The spherical shape of the granular additive can equally adsorb forces from all directions.

Furthermore, spheres of a size of 50-140 microns of a granular additive that is at least about 3% of the solder composition can provide enough stress absorption in small increments to collectively prevent the solder from separating from or cracking glass.

In contrast, Melton discloses a tin, bismuth, gold (or silver) and flux paste which is melted together during reflow. All of the elements melt, so that none of the elements remain in granular form within an alloy. In addition, Melton does not disclose pretreating only a granular additive as claimed, and does not address issues of evenly dispersing a granular additive.

Koning discloses a filled solder having a coated filler particle of low CTE material, such as graphite, carbon fiber, diamond, boron nitride, aluminum nitride, silicon carbide, silicon nitride, zinc oxide, alumina, titanium diboride and silica. Koning does not teach or suggest spheres 50-140 microns in size or spheres of nickel iron alloy.

JP 57152438 discloses a thermal expansion regulating material having Fe-Ni (iron nickel) alloy powder surface coated with Mo (molybdenum) or W (tungsten) that is mixed with Cu (copper) powder, and compressed and sintered. A compressed sintered product is not melted to a level that causes mixing to form molten alloy. Instead the particles attach to each other to form the desired shape. The sintered nickel iron powder teaches away from being added to a tin silver alloy in a granular form. In addition, JP 57152438 does not teach or suggest spheres 50-140 microns in size.

Accordingly, Claims 1, 5, 6, and 16-18, as amended, are not obvious in view of Melton, Koning and JP 57152438 since none of the references, alone or in combination, teach or suggest "an alloy comprising tin (Sn) and silver (Ag); and a granular additive pretreated with flux added to the granular additive, which is at least about 3% of the solder composition by weight, only the granular additive being pretreated with flux and comprising spheres of a nickel iron alloy 50-140 microns in size comprising about 36% nickel (Ni) and about 64% iron (Fe), by weight, the pretreated granular additive being in granular form within said alloy and being wetted with the alloy by the flux," as recited in base Claim 1, as amended, or "an alloy comprising tin and silver; and a granular additive pretreated with flux added to the granular additive and comprising spheres of a material having a low coefficient of thermal expansion 50-140 microns in size and being at least about 3% of the solder composition by weight, only the granular additive being pretreated with flux, the pretreated granular additive being in granular form in said alloy and

being wetted with the alloy by the flux," as recited in base Claim 16, as amended. Therefore, Claims 1, 5, 6, and 16-18, as amended, are in condition for allowance. Reconsideration is respectfully requested.

Beal discloses on Page 434 typical inorganic flux constituents, including zinc chloride, ammonium chloride and hydrochloric acid, which function well with torch, oven, resistance or induction soldering methods. Page 429 of Beal teaches that iron and nickel are not normally present in solder alloys, and specifications usually limit the iron and nickel content to a maximum of .02%. In addition, severe reductions in wetting properties have been observed with higher levels.

Accordingly, Claims 3 and 20 are not obvious in view of Melton, Koning, JP 57152438 and Beal, since none of the references, alone or in combination, teach or suggest "an alloy comprising tin (Sn) and silver (Ag); and a granular additive pretreated with flux added to the granular additive, which is at least about 3% of the solder composition by weight, only the granular additive being pretreated with flux and comprising spheres of a nickel iron alloy 50-140 microns in size comprising about 36% nickel (Ni) and about 64% iron (Fe), by weight, the pretreated granular additive being in granular form within said alloy and being wetted with the alloy by the flux," as recited in Claim 1, as amended, and "an alloy comprising tin and silver; and a granular additive pretreated with flux added to the granular additive and comprising spheres of a material having a low coefficient of thermal expansion 50-140 microns in size and being at least about 3% of the solder composition by weight, only the granular additive being pretreated with flux, the pretreated granular additive being in granular form in said alloy and being wetted with the alloy by the flux," as recited in Claim 16, as amended. Therefore, Claims 3 and 20 are in condition for allowance. Reconsideration is respectfully requested.

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CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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